

SYSTEM AND METHOD FOR VOICE MAIL SERVICE IN AN ENVIRONMENT HAVING MULTIPLE VOICE MAIL TECHNOLOGY PLATFORMS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. Provisional Patent Application No. 60/450,738, filed February 27, 2003, which is entirely incorporated herein by reference.

BACKGROUND OF THE INVENTION

Field of Invention

[0002] This invention relates to voice mail service. More particularly, the invention relates to a system and method for providing voice mail service in an environment having multiple voice mail technology platforms.

Description of Related Art

[0003] Voice mail is an extremely useful business and personal tool that allow callers to leave voice messages when the called party is not available to take an incoming call directly. As such, voice mail has been implemented by many telephone carriers, both wireline and wireless, as an additional benefit for their subscribers.

[0004] In a typical wireless application, a call to a wireless subscriber is routed to the subscriber's home Mobile Switching Center (MSC). If the subscriber's wireless terminal is not on the network or if the subscriber does not respond to a call page over the Public Land Mobile Network (PLMN), the MSC forwards the call and information regarding the subscriber, including the subscriber's phone number, to a Network-based Voice Mail System (NVMS). The NVMS then records a message from the caller and stores the message in a "mailbox" associated with the subscriber's identity (e.g. phone number) for later retrieval by the subscriber.

[0005] A typical wireline application would mirror the wireless application using equivalent wireline telecommunication system elements.

[0006] Recently, with the development of Multimedia Messaging Service (MMS), telephone carriers have proposed using MMS to deliver voice mail messages in the form of voice clips directly to the subscriber's MMS-capable terminal. The MMS-capable terminal could be either a wireless or wireline terminal. The voice mail message would then be stored on the

memory of the MMS-capable terminal. Once the message is on the terminal, the user can access it whenever and wherever they want, without issues such as wireless coverage or airtime usage.

[0007] However, there are advantages and disadvantages that exist with respect to both NVMS and MMS voice mail service.

[0008] For instance, when there is a new message in a NVMS mailbox, the NVMS will generate a notification to alert the subscriber regarding the presence of the new message. Upon receiving the notification, the subscriber must call into the NVMS, go through an identification and authentication process, and interact with the VMS before accessing the voice mail message. This process is confusing to some subscribers, as NVMS questions continually rank at the top of the list of reasons that subscribers call customer service. Delivery of voice mail messages in the form of voice clips directly to the subscriber's wireless terminal using MMS eliminates the identification, authentication and interaction process of NVMS.

[0009] Wireless service carriers often provide NVMS service at "no charge" and depend on subscriber air-time usage for accessing their NVMS mailbox to pay for the NVMS costs, including, for example, the purchase, maintenance, support and operation of the NVMS. Some subscribers never activate their NVMS mailbox, and others receive only a few messages per billing cycle, which does not allow the wireless carrier to recover the NVMS costs for that subscriber. With MMS voice mail service, voice mail messages are stored on the MMS terminal, thus eliminating the costs associated with NVMS.

[0010] However, MMS based voice mail service also has limitations and constraints that give rise to problems for subscribers and wireless carriers.

[0011] For instance, MMS terminals have limited storage capacity, which limits the number of voice mail messages that can be stored on the terminal. Thus, MMS based voice mail service is not practical for subscribers that receive a large number of voice mail messages on a regular basis. For subscribers that receive a large number of voice mail messages, NVMS provides the capacity to meet those needs.

[0012] Also, as mentioned earlier, wireless service carriers may depend on subscriber air-time usage for accessing their NVMS to pay for the NVMS costs. However, with MMS based voice mail service, there is no air-time usage to generate revenue and wireless carriers would either have to charge subscribers for voice mail message delivery, or absorb the cost. For low volume subscribers, the cost for MMS delivery of a few voice mail messages is low compared

with the costs of NVMS service. But for high volume subscribers, the NVMS service is more economical for the wireless carriers and supports "no charge" service for the subscribers.

[0013] Neither NVMS voice mail service nor MMS based voice mail service meets all of the various described subscriber and carrier needs. Further, it is anticipated that as other technologies are developed and implemented for voice mail service, there will still be various needs that are better met by alternate technologies. Thus, there is a need for a system and method for providing voice mail service in an environment having multiple voice mail technology platforms, where the voice mail platform can be custom selected based on the various needs of the subscribers and the carriers.

SUMMARY OF THE INVENTION

[0014] The present invention solves these needs, and others, by providing a system and method for providing voice mail service in an environment having multiple voice mail technology platforms. The invention provides an Automatic Message Attendant (AMA) device which, advantageously, can be positioned on the front end of the multiple voice mail technology platforms. Additionally, the AMA device may perform the greeting and record functions of a voice mail system, thereby removing those functions from the voice mail platforms or allowing systems not having such functions to be used for voice mail service.

[0015] Generally described, a system of the invention includes a subscriber profile database relating voice mail technology platform indicator information for a plurality of subscribers to corresponding subscriber identities, and an Automatic Message Attendant device. The AMA device has a platform selector element. The subscriber profile database is in communication with the platform selector element. The platform selector element is operative to receive call information regarding a call to a subscriber, where the call information includes the identity, i.e. the telephone number, of the subscriber to whom the call was placed. Additionally, the platform selector element is also operative to obtain voice mail technology platform indicator information from the subscriber profile database by utilizing the subscriber identity. Lastly, the platform selector element operates to select a voice mail technology platform by using the voice mail technology platform indicator information obtained from the subscriber profile database.

[0016] More specifically, the system of the invention may have a common signaling network, where the platform selector element is in communication with the common signaling

network. In this configuration, the platform selector element will receive the call information through the common signaling network from a communications switch. Then, the platform selector element may operate to provide a routing address for the selected voice mail technology platform to the communications switch through the common signaling network.

[0017] Alternatively, in accordance with another aspect of the invention, the automatic message attendant device may operate as a pass-through switch to connect the caller with the selected voice mail technology platform.

[0018] In accordance with yet another aspect of the invention, the system may further have an audio announcement database which relates personal greeting information for a plurality of subscribers to the corresponding identities of those subscribers. This personal greeting information may be a recorded greeting from the subscriber or system greeting information. The automatic message attendant device may further have a greeting player and message recorder element which is in communication with the audio announcement database and the platform selector element. In this configuration, the greeting player and message recorder element operates to obtain the personal greeting information for the subscriber from the audio announcement database using the subscriber's identity. Then the greeting player and message recorder element will play a greeting to the caller as indicated by the personal greeting information and record a voice mail message from the caller to the subscriber. Advantageously, the system may then either forward the recorded message to the selected voice mail technology platform, or forward it to a content adapter element of the AMA device.

[0019] Thus, in another implementation, the AMA device may further have a content adapter element, and the system may further have a message format requirement database. The message format requirement database would contain message format requirement information corresponding to subscribers to the system. The content adapter element would be in communication with the message format requirement database. Further, in this implementation, the content adapter element attains the message format requirement format information for the subscriber from the message format requirement database utilizing the subscriber identity, and converts the recorded voice mail message to the format indicated by the message format requirement information. The content adapter element may then forward the formatted message to the selected voice mail technology platform.

[0020] Generally, a method of the invention utilizes a subscriber profile database which contains voice mail technology platform indicator information associated with a number of

subscribers. An Automatic Message Attendant (AMA) device then receives information regarding a call from a caller to be directed to a voice mail technology platform. The call information includes an identity (e.g. phone number) of the subscriber to whom the call was placed. Then, the AMA device obtains the voice mail technology platform indicator information from the subscriber profile database using the subscriber identity. With this information, the AMA device then selects a voice mail system platform. Upon selection of the voice mail system platform, the AMA device may then direct the caller to the selected voice mail technology platform. This step of directing the caller to the platform may include either providing a routing address for the selected platform to a communications switch through a common signaling network, or connecting said caller directly to the selected voice mail technology platform.

[0021] Alternatively, rather than directing the caller to the selected platform, the AMA device may additionally obtain personal greeting information for the subscriber from an announcement database, play a greeting to the caller as indicated by the personal greeting information, and record a voice mail message from the caller to the subscriber. Thus, the greet and record function may be performed in the AMA device. Then, the recorded message may be forwarded to either the selected voice mail technology platform, or a content adapter element.

[0022] Thus, in accordance with another aspect of the invention, the AMA device may also have a content adapter element and the method may include additional steps to perform a content adaptation function. These additional steps include obtaining message format requirement information for the subscriber from a message format requirement database, and converting the recorded voice mail message to the format indicated by the message format requirement information. Then, the converted message may be forwarded to the selected voice mail technology platform.

[0023] Thus, the invention provides a system and method for providing voice mail service in an environment having multiple voice mail technology platforms, where the voice mail platform can be custom selected based on the various needs of the subscribers and the carriers.

[0024] The invention is not limited to the preceding description and will be better understood by reference to the following detailed description and the appended drawings and claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] FIG. 1 is a functional block diagram of an exemplary system according to the invention.

[0026] FIG. 2 is a logic flow diagram of an exemplary method of the invention.

[0027] FIG. 3 is a diagram of an embodiment of the invention incorporating the functionality of FIG. 1, showing an example of a delivery system architecture.

[0028] FIG. 4 is a diagram of another embodiment of the invention incorporating the functionality of FIG. 1, showing an example of another delivery system architecture.

[0029] FIG. 5 is a diagram of another exemplary system according the invention.

[0030] FIG. 6 is a logic flow diagram of another exemplary method of the invention.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

[0031] A system or method in accordance with the present invention may be used to provide voice mail service in any environment having multiple voice mail technology platforms. The invention provides an Automatic Message Attendant (AMA) device having a platform selection element placed between the caller and the multiple voice mail technology platforms. The AMA device can serve a switching function, physically relaying a call from a communication switch to the selected voice mail technology platform, or the AMA device can serve a director function, providing routing instructions over a common signaling network, such as a SS7 network, so that the call can be routed from the communication switch to the selected voice mail technology platform.

[0032] The platform selection function is accomplished by receiving information regarding a call forwarded from a communication switch upon a triggering event, such as a failure to answer the call within a predetermined amount of time, or if a mobile terminal is not available on, or in range of, a wireless network. The AMA device can then obtain profile information for the subscriber to whom the call was placed that indicates the voice mail technology platform used for voice mail for the subscriber, and select the voice mail technology platform as indicated by the profile information. The profile information is located in a subscriber profile database, which can be provisioned based on the voice mail technology needs of the subscriber and carrier.

[0033] The present invention applies to telecommunication systems which may be implemented using a variety of technologies, including but not limited to electrical and electronic systems using microprocessors and other processing components, and software and other collections of steps and instructions, for implementing processes in conjunction with such systems. The embodiments described herein are exemplary. Thus, although some specific technologies are discussed, other equivalent technologies could be used to implement systems and methods in keeping with the spirit and teachings of the present invention. Additionally, unless otherwise noted, references to apparatus or data structures for conveying a signal or information are intended to refer generally to all functionally equivalent apparatus and data structures.

[0034] The exemplary voice mail technology platforms discussed herein include: 1) a Network-based Voice Mail System (NVMS); 2) a MMS-based Voice Mail System (MMS VMS),

both of which are capable of call termination, and 3) a system which uses Multimedia Messaging Services Center (MMSC) architecture to provide voice clip delivery. However, the principles taught herein will apply to any environment having multiple voice mail technology platforms. For the purpose of this discussion, a voice mail technology platform is a system capable of providing voice mail service for a subscriber in any form.

[0035] As described above, a Network-based Voice Mail System (NVMS) receives a call and the identity of the subscriber to whom the call was placed. The call is forwarded from a communication switch in the carrier's network. Typically, the call is forwarded over a trunk connection between the switch and the NVMS, such as a Multi-Frequency (MF) trunk connection. However, the call could be forwarded over a single line or any other mechanism for connecting the caller to the NVMS. The subscriber identity can be transmitted using in-band or out-of-band signaling, such as through the use of a common signaling network (SS7 or the equivalent). The communication switch could be any switching component of a telecommunication system, such as a switching office in a wireline system, or a Mobile Switching Center (MSC) in a wireless system. The call would be forwarded upon a triggering event, such as a failure to answer the call within a predetermined amount of time, or if a mobile terminal is not available on, or in range of, a wireless network. The NVMS then terminates the call by playing a greeting to the caller, recording a message from the caller, and storing the message in a "mailbox" associated with the subscriber's identity. The subscriber can then access the mailbox via a communication system, such as a Public Switched Telephone Network (PSTN) or a Public Land Mobile Network (PLMN), to retrieve the stored message.

[0036] A MMS Voice Mail System (MMS VMS) operates in much the same way as a NVMS, receiving a call and the identity of the subscriber to whom the call was placed from a communication switch, and terminating the call by playing a greeting to the caller and recording a message from the caller. However, rather than storing the message, the MMS VMS delivers the message directly to the subscriber's MMS-capable terminal in the form of a voice clip. The MMS-capable terminal can be any wireless or wireline MMS-capable communication device, such as a telephone, a Personal Digital Assistant (PDA), or a Personal Computer (PC).

[0037] The Multimedia Messaging Services Center (MMSC) architecture provides a store and forward facility for multimedia messages (e.g. in the form of voice clips) that have already been captured or recorded. The MMSC architecture supports general text, audio, images, and video format messages.

[0038] As a result of its location on the front end of the voice mail technology platforms, the invention itself may also provide call termination, greeting player and message recorder functions, and capabilities for forwarding the recorded message to the selected voice mail technology platform via a data connection, such as an IP or X.25 connection. Thus, the AMA device may advantageously be used in connection with a MMSC architecture in order to enable the MMSC architecture platform to serve in a Voice Mail System. Furthermore, content adaptation may advantageously be performed at this front end location in order to put the recorded message into a format acceptable to the subscriber's MMS-capable terminal. Thus, carriers are able to add the AMA device as a front-end intelligent adjunct to their existing NVMS, MMS VMS, and MMSC platforms in order to create a flexible system having multiple voice mail technology platforms.

[0039] The mechanism for delivery of the voice mail message from the selected voice mail system platform to the subscriber can be any type of communication network. For example, delivery of the voice mail message can be by any known wireless or wireline technology, such as: Global System for Mobile Communications (GSM); Code Division Multiple Access (CDMA); Time Division Multiple Access (TDMA); Wireless Fidelity (WiFi); General Packet Radio Service (GPRS); Enhanced Data for GSM Evolution (EDGE); Wideband CDMA (WCDMA); Plain Old Telephone Service (POTS); Integrated Services Digital Network (ISDN); and Digital Subscriber Line (DSL).

[0040] As shown in FIG. 1, an exemplary system 100 for providing voice mail service in an environment having multiple voice mail technology platforms 110 includes an Automatic Message Attendant (AMA) device 112 and a subscriber profile database 114. The AMA device 112 has a platform selector element 116. The platform selector element 116 is in communication with the subscriber profile database 114 via an appropriate data link 118, such as a Lightweight Directory Access Protocol (LDAP) link or an internal bus connection in the event that the database 114 is integrated with the platform selector element 116. The subscriber profile database 114 is provisioned with voice mail technology platform indicator information for subscribers.

[0041] In operation, a caller 120 places a call 122 to a subscriber 124. The call 122, or information about the call, reaches a communication switch 126 through a telecommunication network 128 for connection of the caller 120 to the subscriber 124. However, upon a triggering event which indicates that the caller 120 should be connected to a voice mail system, the

communication switch **126** will deliver information about the call to the AMA device **112**, or, more particularly, to the platform selector element **116**. The call information delivery is accomplished through an appropriate signaling means **130**, such as in-band signaling over the call circuit or out-of-band signaling, such as over a common signaling network (i.e. a SS7 network or the equivalent). The call information includes an identity (e.g. phone number) of the subscriber to whom the call was placed. The platform selector element **116** then obtains profile information for the subscriber **124** from the subscriber profile database **114**. The profile information includes the voice mail technology platform indicator information for the subscriber **124**. The platform selector element **116** then selects a voice mail system platform **110** by using the voice mail technology platform indicator information. The call **122** and the subscriber identity can then be delivered by an appropriate delivery system architecture **132** to the appropriate voice mail technology platform for providing voice mail service for the subscriber **124**.

[0042] Thus, FIG. 2 shows the logical flow of a method used in the exemplary system **100** of FIG. 1. In the first step **140**, the AMA device **112** receives call information from a communication switch **126**, where the call information includes the identity (e.g. the telephone number) of the subscriber to whom the call was placed. In the next step **142**, the AMA device **112** queries the subscriber profile database **114** for profile information for the subscriber **124**, where the profile information includes voice mail technology platform indicator information for the subscriber. In the next step **144**, the AMA device **112** selects a voice mail technology platform using the voice mail technology platform indicator information obtained in the previous step **142**. In the last step **146**, the AMA device **112** directs the delivery of the call **122**, and the identity of the subscriber to whom the call was placed, to the selected voice mail technology platform for call termination.

[0043] There are multiple delivery system architectures **132** that can be utilized by the system **100**, such as a Service Control Point (SCP)-type/IN architecture or a service node architecture. In a SCP-type/IN architecture, the AMA device **112** could return a routing address for the selected voice mail technology platform to the communication switch **126**, so that the call **122** could be routed directly to the selected voice mail technology platform. In the service node architecture, the AMA device **112** could serve as a pass-through switch, passing the call **122** through the AMA device **112** to the selected voice mail technology platform or to another call termination element for use with a MMSC platform, as described below.

[0044] FIG. 3 illustrates an exemplary embodiment of the present invention using a SCP-type/IN delivery architecture wherein the necessary signaling is accomplished through a common signaling network **134**, such as a SS7 network. In this example, the AMA device **112** provides the routing address for the selected voice mail technology platform to the communication switch **126** through the common signaling network **134**. The call **122** can then be routed to the selected voice mail technology platform through the telecommunication network **128**, which could be a PSTN or a PLMN.

[0045] FIG. 4 illustrates an exemplary embodiment of the present invention using a service node type delivery architecture wherein the AMA device **112** acts as a pass-through switch, delivering the call **122** to the selected voice mail technology platform with appropriate connections **136** through the AMA device **112**. Such connections **136** could be trunk-type connections, such as MF connections, or individual lines. In this example, the necessary signaling may be accomplished as either in-band signaling or out-of-band signaling (not shown).

[0046] FIG. 5 shows another exemplary system **200** for providing voice mail service in an environment having multiple voice mail technology platforms **210**, **212**. The system **200** of FIG. 5 incorporates the elements and features of the system **100** of FIG. 1 and adds expanded functionality. In particular, the system **200** is shown with one voice mail technology platform being a NVMS or MMS VMS platform **210**, and with another platform being a MMSC architecture platform **212**, such as might be present in many telecommunication carrier systems. The system **200** includes an AMA device **214**. The AMA device **214** has a platform selector element **216**, a greeting player and message recorder element **218**, and a content adapter element **220**. Additionally, the system **200** includes: a subscriber profile database **222** in communication with the platform selector element **216**; an announcement database **224** in communication with the greeting player and message recorder element **218**, and a message format requirement database **226** in communication with the content adapter element **220**. All of the database connections are achieved through appropriate data links, such as LDAP protocol links or internal bus connections in the event of integration with their respective elements. The subscriber profile database **222** is provisioned with voice mail technology platform indicator information for subscribers. The announcement database **224** is provisioned with personal or system greeting information for subscribers. The message format requirement database **226** is provisioned with message format requirement information for subscribers, for the purpose of content adaptation.

[0047] In operation, a caller **228** places a call **230** to a subscriber **232**. The call **230**, or information about the call, reaches a communication switch **234** through a telecommunication network **236** for connection of the caller **228** to the subscriber **232**. Upon a triggering event which indicates that the caller **228** should be connected to a voice mail system, the communication switch **234** will deliver information about the call to the AMA device **214**, or, more particularly, to the platform selector element **216**. The call information delivery is through an appropriate signaling means **238**, such as in-band signaling over the call circuit or out-of-band signaling, such as over a common signaling network (i.e., a SS7 network or the equivalent). The call information includes an identity (e.g., phone number) of the subscriber to whom the call was placed. The platform selector element **216** then obtains profile information for the subscriber **232** from the subscriber profile database **222** using the subscriber identity. The profile information includes voice mail technology platform indicator information for the subscriber **232**. The platform selector element **216** then selects a voice mail technology platform by using the voice mail technology platform indicator information.

[0048] If the selected voice mail technology platform is the NVMS or MMS VMS platform **210**, the call **230** and the subscriber identity can then be delivered by an appropriate delivery system architecture **240**, such as described earlier, for call termination at the selected platform **210**.

[0049] However, if the selected voice mail technology platform is the MMSC architecture platform **212**, the subscriber identity will be delivered to and the caller **228** will be connected with the greeting player and message recorder element **218**. The greeting player and message recorder element **218** then obtains personal or system greeting information for the subscriber **232** from the announcement database **224** using the subscriber identity. The greeting player and message recorder element **218** then plays the subscriber's personal or system greeting to the caller **228**, and records a message from the caller **228**. Thus, the greeting player and message recorder element **218** provides termination of the call, much like the NVMS or MMS VMS platform **210** does. Once recorded, the greeting player and message recorder element **218** can forward the message and the subscriber identity to the content adapter element **220** over an appropriate data link **242**, or, directly to the MMSC architecture voice mail platform **212** (not shown).

[0050] The message may be directed to the content adapter element **220** since various MMS-capable terminals may have differing voice clip message format requirements.

The content adapter element **220** may then obtain message format requirement information for the subscriber **232** (or, more accurately, the subscriber's MMS-capable terminal) from the message format requirement database **226** using the subscriber identity. The content adapter element **220** then converts the recorded voice mail message to the format indicated by the message format requirement information. Once converted, the content adapter element **220** can forward the formatted message and the subscriber identity to the MMSC **212** for delivery to the subscriber **232** (or to the subscriber's MMS-capable terminal) over an appropriate data link **244**, such as an IP protocol or an X.25 protocol link.

[0051] Another possible configuration shown on FIG. 5 is moving the call termination function from the NVMS or MMS VMS platform **210** to the greeting player and message recorder element **218**, and delivering the recorded message and the subscriber identity to the NVMS or MMS VMS platform **210** over an appropriate data link **246**.

[0052] Additionally, it should be noted that the content adapter element **220** could be combined with the greeting player and message recorder element **218**, such that the combined greeting player, message recorder and content adapter element (not shown) would deliver a properly formatted message to the selected voice mail technology platform over an appropriate data link.

[0053] Further still, the content adapter function could be moved to the selected voice mail technology platform, such that the voice mail platform would receive the recorded message from the greeting player and message recorder element **218** and perform any necessary content conversion at the voice mail platform.

[0054] FIG. 6 shows the logical flow of a method used in the exemplary system **200** of FIG. 5. In the first step **250**, the AMA device **214** receives call information from a communication switch **234**, where the call information includes the identity (e.g. the telephone number) of the subscriber to whom the call was placed. In the next step **252**, the AMA device **214** queries the subscriber profile database **222** for profile information for the subscriber **232**, where the profile information includes voice mail technology platform indicator information for the subscriber. In the next step **254**, the AMA device **214** selects a voice mail technology platform using the voice mail technology platform indicator obtained in the previous step **252**.

[0055] If the NVMS or MMS VMS platform **210** is selected, the call and the call information can then be directed to the NVMS or MMS VMS platform **210**.

[0056] If the MMSC architecture platform is selected, the greeting player and message recorder element **218** of the AMA device **214** queries the announcement database **224** for personal greeting information for the subscriber **232** in the following step **256**. In the next step **258**, the greeting player and message recorder element **218** plays the personal greeting to the caller, and records a message for the subscriber. In the succeeding step **260**, the content adapter element **220** of the AMA device **214** queries the message format requirement database **226** for message format requirement information for the subscriber **232**. In the succeeding step **262**, the content adapter element **220** converts the recorded voice mail message to the format indicated by the message format requirement information. In the last step **264**, the AMA device **214** delivers the message to the subscriber **232** (or to the subscriber's MMS-capable terminal) through the MMSC architecture platform.

[0057] In the above description of the present invention, it should be recognized that the AMA device, including the described elements thereof, and the various database elements may be implemented on digital computing equipment, or the equivalent, through the use of computer programs, or the equivalent. Thus, the method of the invention may be found as executable instructions contained on a computer readable medium.

[0058] Thus, the invention provides a system and method for providing voice mail service in an environment having multiple voice mail technology platforms where the voice mail platform can be custom selected based on the various needs of the subscribers and the carriers, as indicated in the subscriber profile database, among other benefits and features.

[0059] One of ordinary skill in the art will recognize that additional configurations are possible without departing from the teachings of the invention or the scope of the claims which follow. This detailed description, and particularly the specific details of the exemplary embodiments disclosed, is given primarily for clearness of understanding and no unnecessary limitations are to be understood therefrom, for modifications will become obvious to those skilled in the art upon reading this disclosure and may be made without departing from the spirit or scope of the claimed invention.